

27. (New) A gas detector comprising:

a discharge tube made of sapphire in which gas is carried for conversion to a plasma therein;

an enclosed passageway surrounding the discharge tube thorough which cooling air moves, such contained cooling air coming in contact with the outer surface of the discharge tube before the outlet of the discharge tube; and

apparatus encircling the discharge tube and the enclosed passageway and located before the outlet of the discharge tube, such apparatus subjecting the discharge tube and enclosed passageway to sufficient amounts of radio frequency or microwave energy to generate plasma in the discharge tube from the gas, such radio frequency or microwave energy not effecting the cooling air.

28. (New) The gas detector of Claim 27 wherein the apparatus encircling the discharge tube and the enclosed passageway subjects the discharge tube and enclosed passageway to sufficient amounts of microwave energy to generate plasma in the discharge tube from the gas, such microwave energy not effecting the cooling air.

REMARKS

This Response amends the claims in the application. Claims 1-3, 5-22, 25, and 26 are cancelled. Claims Independent Claims 27 and 28 are added. Claims 4 and 23 have been amended. Accordingly, pending in the application are Claims 4, 23, 24, 27 and 28. Claim 27 is independent.

Drawings

It is submitted that this Response overcomes the objection to the draws in the Office Action under 37 CFR 1.83(a). Claims 1,2,3,21, 25, and 26 have been cancelled. Consequently, there is no need to amend the drawings.

Claim Rejection under 35 USC § 112

It is submitted that this Response overcomes the rejection of Claims 1-5, 7-8, and 21-26 under 35 USC § 112 in the Office Action. This Response cancels Claims 1-3, 5, 7-8, 21-22, and 25-26. Although the Response does not cancel Claims 4, 23, and 24, Claims 4 and 23 are made dependent on new dependent Claim 28 and new independent Claim 27 respectively. And Claim 24 is dependent on Claim 23. Independent Claim 27 does not recite a heater.

Claim Rejection under 35 USC § 102

It is submitted that this Response overcomes the rejection of Claims 21, 22, 25, and 26 under 35 USC § 102(b). The Response cancels these claims.

Claim Rejection under 35 USC § 103

Unlike the cited Meyer reference (U.S. Patent No. 4,482,246), the Applicant's claimed invention uses a discharge tube made of sapphire in which gas is converted to plasma therein before the tube's outlet. An enclosed passageway through which cooling air moves surrounds the discharge tube. Because the contained cooling air comes in contact with the outer surface of the discharge tube, the air cools the tube before its outlet. Such cooling is needed because heat generated from the conversion of gas to plasma. Apparatus encircles the discharge tube before its outlet and the enclosed passageway. Such apparatus subjects the discharge tube and enclosed passageway to sufficient amounts of radio frequency or microwave energy to generate plasma in the discharge tube before its outlet. The radio frequency or microwave energy, unlike water,

does not effect the cooling air. Water absorbs some radio frequency or microwave energy.

The inventor found longer life of the sapphire discharge tubes using air cooling in the claimed configuration.

Submitted with this Response is a copy of the U.S. Patent 4,654,504 (incorporated by reference into the instant application), which indicates difficulty with air as a coolant with a gas detector. At column 1, lines 44-49, the patent states:

“Whereas it seemed that air could be used as a coolant, it was found that its thermal impedance was so different from that of the materials from which the discharge tube is generally made that the rate of flow of heat into the air was too low to obtain sufficient cooling, even though the flow of air was raised to a high level.’

That was the finding of the inventor, until he discovered air cooling with a discharge tube made of sapphire, which gave longer life.

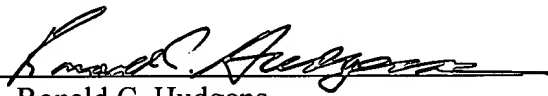
In contrast to the applicant’s detector, the Meyer reference (U.S. Patent No. 4,482,246) discloses a inductively coupled plasma (ICP) torch where the plasma is generated at the outlet of the containment tube 1 by an induction coil 20 encircling the only the containment tube 1 at its outlet. This arrangement is plainly seen in Figure 2. The discharge arrangement of the plasma torch has coolant supplied in an outer annulus 9 between tubes 1 and 2 (column 3, lines 54-57). But induction coils 20 high frequency energy heats the plasma 18 after the coolant exits or is released inside the containment tube from the annulus 9. Consequently, the coolant cools the containment tube 1 from the

inside and is exposed to the plasma. This is in contrast to applicant's claimed detector in which contained cooling air is in touch with the exterior surface of the discharge tube before its outlet and is not exposed to plasma.

In view of the foregoing, it is believed that this Response overcomes all of the rejections and that the claims in the application clearly and patentably distinguish over all of the cited references, either alone or in combination. Therefore, the Examiner's reconsideration and favorable action are hereby respectfully requested.

Respectfully submitted,

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